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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/602,488	06/23/2003	Tatyana N. Andryushchenko	42P16161	1128

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EXAMINER

GURLEY, LYNNE ANN

ART UNIT	PAPER NUMBER
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2812

DATE MAILED: 05/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/602,488

Applicant(s)

ANDRYUSHCHENKO ET AL.

Examiner

Lynne A. Gurley

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 25 January 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-22 and 34-44 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-22 and 34-44 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.


**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

  
**LYNNE A. GURLEY**  
**PRIMARY PATENT EXAMINER**  
**TC 2800, AU 2812**

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/14/06.

- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

This Office Action is in response to the amendment, and remarks filed 1/25/06.  
Currently, claims 1-22 and 34-44 are pending.

#### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-5, 8, 11-16, 19, 22, 34-38, 41, and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Yao et al. (2004/0253809, dated 12/16/04, filed 8/15/02).

Yao shows the method as claimed in figures 1-6 and corresponding text, especially figure 2D for removal of the barrier layer.

3. Claims 1-5, 8, 11-16, 19, 22, 34-38, 41, and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by Ho et al. (US 2002/0115283, dated 8/22/02).

Ho shows the method as claimed in figure 3 and corresponding text, for removal of the barrier layer 225b.

4. Claims 1-5, 8, 11-16, 19, 22, 34-38, 41, and 44 are rejected under 35 U.S.C. 102(b) as being anticipated by Lopatin et al. (US 6,495,443, dated 12/17/02).

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Lopatin shows the method as claimed in figures 1-9 and corresponding text, for removal of the barrier layer 116.

***Claim Rejections - 35 USC § 103***

1. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).
3. Claims 1-22 and 34-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uzoh et al. (US 6,780,772, dated 8/24/04, filed 12/21/01) in view of Jorne et al. (US 2004/0072423, dated 4/15/04, filed 1/14/02).

Uzoh shows the method substantially as claimed, in figures 1-9 and corresponding text, as providing a wafer 202 (fig. 4), the wafer comprising an inter-layer dielectric (ILD) 210 having a feature therein 204 (fig 4; column 4, lines 50-61), an underlayer 208 (the first layer of the multi-layered barrier layer; column 4, lines 61-67) deposited on the ILD, a barrier layer 208 (remaining layers of the multi-layered barrier layer) deposited on the under-layer and a conductive layer 206 (Cu; column 5, lines 1-4) deposited on the barrier layer; exposing the barrier layer (Fig. 9A) and removing the barrier layer (fig. 9B). The removal of the barrier layer and the conductive layer is performed by electropolishing (column 8, lines 37-67; column 9, lines 1-7). The conductive layer is copper. The barrier comprises tantalum (Ta). The under-layer is TaN. A portion of the under-layer and/ or the conductive layer may be removed using CMP (column 8, lines 37-67; column 9, lines 1-7).

Uzoh lacks anticipation only in not explicitly teaching the specifics of the electropolishing process, i.e.: 1) that the wafer is placed in an electrolyte, such that at least the barrier layer is immersed in the electrolyte; and an electrical potential is applied between the wafer and an electrode immersed in the electrolyte until at least part of the barrier layer is removed; 2) the electrolyte has a pH equal to or greater than 10; 3) the electrolyte comprises a solution of KOH, NaOH, NH<sub>4</sub>OH or TMAH; 4) an additive is added to the electrolyte; 5) the additive is an oxidizer, a corrosion inhibitor, a surfactant, a buffer, a complexor or combinations thereof; and 6) the electric potential has a value equal to or greater than 0.5V with respect to the saturated calomel reference electrode.

Jorne teaches an electropolishing apparatus used to remove conductive layers from a substrate with an electrolytic solution and an applied voltage. Submersion into an

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electropolishing solution or electrolytic solution is taught [0014], [0079], [0092], [0011]-[0012] for the removal of any excess metal layers on the substrate surface outside the contact).

Additives to the electrolyte are discussed in order to keep the electrolyte the proper consistency (column 7, lines 8-30).

It would have been obvious to one of ordinary skill in the art to have placed the wafer in an electrolyte, such that at least the barrier layer is immersed in the electrolyte; and to have applied an electrical potential between the wafer and an electrode immersed in the electrolyte until at least part of the barrier layer is removed, in the method of Uzoh, as taught by Jorne, with the motivation that Uzoh uses an electropolishing method to remove the barrier and the conductive layers, while Jorne teaches the electropolishing apparatus for the same purpose and, additionally, teaches immersion of the conductive layers in the electrolyte and the applied electrical potential between the wafer and an electrode immersed in the electrolyte in order to remove of the conductive layers.

It would have been obvious to one of ordinary skill in the art to have had the electrolyte have a pH equal to or greater than 10; to have had the electrolyte comprise a solution of KOH, NaOH, NH<sub>4</sub>OH or TMAH; to have added an additive to the electrolyte; to have had the additive be an oxidizer, a corrosion inhibitor, a surfactant, a buffer, a complexor or combinations thereof; and to have had the electric potential have a value equal to or greater than 0.5V with respect to the saturated calomel reference electrode, in the method of Uzoh, as supported by Jorne, with the motivation that these are all conventional additives which adjust the rate and efficiency of removal in a conductor removal process (i.e. CMP), especially in the absence of any showing of criticality and, with the motivation that Jorne teaches the modification of the electrolyte by

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various means to keep a desired consistency to optimize the process and adapt the process to different conductive layers [0011], [0025], [0031]-[0032], [0083], [0093]. Additionally, the electropolishing process may be optimized to control any varying local electric fields by changing the voltage applied, the additives which can act as plating suppressors or antisuppressors to modulate the electropolishing (See Cox, US 6,383,917 cited in the PTO Form 892; column 4, lines 48-60).

### ***Response to Arguments***

4. Applicant's arguments, see pages 8-12, filed 1/25/06, with respect to the rejection(s) of claim(s) 1-22 and 34-44 under 35 USC 102 and 35 USC103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the prior art listed below.

### ***Conclusion***

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

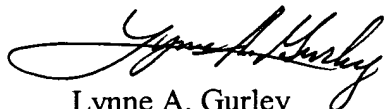
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CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lynne A. Gurley whose telephone number is 571-272-1670. The examiner can normally be reached on M-F 7:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Lynne A. Gurley  
Primary Patent Examiner  
TC 2800, Art Unit 2812

LAG  
May 1, 2006